

Experimental Study on Partial Replacement of Clayey Soil with Rice Husk on Side Skew Bricks

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Abstract:

Bricks are composed of inorganic non-metallic material and are widely used as building components all over the world. All the conventional clay bricks depend on good quality clay available from agricultural fields presuming a weight of 3kg per brick. The main objective of this study is to investigate the effects of rice husk addition, on the compressive strength, water absorption, density, efflorescence and thermal conductivity properties of fired side skew clay bricks. Brick raw material and rice husk obtained from Poochiathipedu, Thiruvallur were used. Mix proportions for the clay brick were carried as per the guidelines. Rice husk was substituted by volume 5% Rice husk, 10% Rice husk and 15% Rice husk to brick raw material and was casted in the form of side skew and standard rectangular bricks. We are adopting side skew brick according to IS 1526-1960 table 1 to get an maximum reflection of incident solar radiation. Application of thermal insulation as an energy saving method is more effective in the region between tropic of cancer and equator. This concept plays an crucial role in the energy consumption of a building. Green building often includes measure to reduce energy consumption service such as cooling in tropical region. The 5% of side skew rice husk combination shows increase in strength while the combination of the 5% rectangular brick shows notable variation with respect to the standard side skew

Keywords:

1. Introduction

1.1 General

A brick is a block made of clay burnt in a kiln. It is one of the primary building materials known to mankind. Bricks are composed of inorganic non-metallic material and are widely used as building components all over the world.

Overtime bricks have appeared gained prominence, lot importance and then come to the for friend again with various styles of architecture.

The need for locally manufactured building materials has been emphasized in many countries of the world because of their easy availability and low cost.

Bricks also have been regarded as one of the longest lasting and strongest building materials, made from locally available sources, used throughout history Indian country is an agriculture country. (Ali Ahmed Mohammed)

The wastage generated from agriculture source are sugarcane, bagasses paddy, wheat and straw and husk, wastes of vegetables, food products, tea, oil production, just fiber, ground nut, shell, wooden mill waste, coconut husk etc. (Bernard Perrin, Laila Aouba)

Out of these one of the major quantity of rice husk annually generated about 20 million tons per year respectively. Rice milling generates a byproduct know as husk. This surrounds the paddy grain.

During milling of paddy about 78% of weight is received as rice, broken rice, bran and rest 22% of the weight of paddy received as husk is used as fuel and rice mills to generate steam for the parboiling process.

1.2 Need of the Project

Building sector is one of the main energy consumers in the world, contributing around 40% of the total energy consumption. (Bernard Perrin, Laila Aouba) In tropical and subtropical areas, cooling in buildings has become essential for thermal comfort, particularly in public buildings such as offices, supermarkets, sport centers, etc., where energy consumption accounts for over 50% of building's energy demands.

All the conventional clay bricks depend on good quality clay available from agricultural fields presuming a weight of 3kg per brick. The total clay taken out from agricultural lands per year for such brick works out to over 300 million tons. The use of rice husk ash for making a brick is advantageous since apart from saving precious top agriculture soil. (Görhan, Osman Şimşek)

1.3 Aim of the Project

The scope of this project is find out the compressive strength of RH in side skew burnt clay brick thereby optimum of RH that can be used in various applications such as load bearing walls and framed structures enhancing the brick quality, by the above procedure the thermal insulation property of the brick is increased.

1.4 Objectives of the Project

- It gives the maximum compressive strength of the project.
- Compare to the normal brick, partially replacement of RH in side skew burnt clay brick is cost effective.

- It also reduces the weight of the brick. The weight of the side skew burnt clay brick can be reduce to 30% of convention all brick
- Reduce the wastage of RH
- Brick with side skew shape provides good quality with sharp edge controlled dimension and offer plain and even finish.
- Bulk utilization of RH helps in solving the pollution problems the bonding with mortar and plaster is much greater or better in the case of side skew burnt clay brick using RH.
- This brick are very easy to produce as they manufacturing, process is simple and machinery required is easily available.
- Application of thermal insulation as an energy saving method is more effective in the region between tropic of cancer and equator.
- This concept plays an crucial role in the energy consumption of a building.

2. Methodology

- Preliminary tests for the samples like rice husk were carried out. Mix proportioning was done according to the guidelines for manufacturing the clay bricks.
- Side skew brick dimension is selected according to IS 1526-1960 table.
- Compressive strength test were carried out for the RH side skew burnt clay bricks using a compression testing machine (CTM) as per IS 3495(part 1) 1992.
- The compressive strength results presented in the report are an average of the reading
- The tests were carried out on partial replacement of RH in manufacturing of our side skew burnt clay brick.
- The water absorption were carried out on partial replacement of RH in manufacturing of our side skew burnt clay brick as per IS 3495(part 2) 1992.
- The efflorescence tests were carried out on partial replacement of RH in manufacturing of our side skew burnt clay brick as per IS 3495(part 3) 1992.

Study of Physical Property

Brick

Brick is made of clay or shale formed, dried and fired into a durable ceramic product. Brick achieves its color through the minerals in the fired clay or through coatings that are applied before or after the firing process. (Konstantinos D. Antoniadis)

Rice hulls

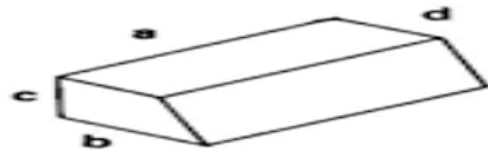
Rice hulls (or rice husks) are the hard protecting coverings of grains of rice. In addition to protecting rice during the growing season, rice hulls can be put to use as building material, fertilizer, insulation material, or fuel.

Brick Dimension

Sun is major energy source, which is obtained in the form of solar radiation. The angle of solar radiation plays a major role in the room temperature of a building. The power incident on a PV module depends not only on the power contained in the sunlight, but also on the angle between the module and the sun. β is the tilt angle of the module measured from the horizontal. Indian sub-continent is located in tropic of cancer passing through it center. Indian sub-continent receives huge amount of solar radiation every second. The average angle of solar radiation in India is 30° .

Selection Of Brick

According to IS 1526-1960 table 1, We select side skew type of brick.



2.1 Dimension of Brick

According to IS 1526-1960 Table 1

Dimension of side skew brick that we are taking are

$a=230$ mm

$b=113$ mm

$c=70$ mm

$d=75$ mm

So that side angle of brick is 60° .

2.2 Mould Preparation

According to dimension of IS 1526-1960

Mould for clay brick is done



Fig. 2.1: Brick Preparation Side Skew

Burnt Clay Brick

- The burnt clay brick are prepared in a dimension of 19X9X9 CM.
- During the preparation of mortar add 5%, 10%, 15% of rice husk individually.
- The mixed proportion clay is filled in the mould and compacted as much as possible.
- Then place the mortar on the wheel barrow and drop down at the place, where it is to be casted
- The top surface of the brick is levelled and the red mud of fine size is thrown over it.

3. Test for Bricks

3.1 Compressive Strength Test

- The compressive strength test on bricks is used to determine the load carrying capacity of bricks under compression.

- The test is carried out with the help of compression testing machine.
- Make surface of the brick even by grinding the surface and the cover the frog of the brick using cement mortar of ratio (1:1).



Fig. 3.1: Compressive Strength

3.2 Water Absorption Test:

- The water absorption test in bricks is carried out to determine the quantity of water absorbed by the brick.
- If the brick absorbs more water then it affect the load carrying capacity of the brick.
- The specimen required for the test is weight balance and burnt brick.
- Take the weight of each brick. let it be W1 and W2.Thwn immerse the brick in water for a period of 24 hrs.
- Then remove the brick and wipe it of with dry cloth and weigh as W2.

The formula used to find out the water absorbed in the brick is
 Water absorption value= $(w_2-w_1)/w_1$
 w_1 =weight of brick before immersed in water for 24hours
 w_2 =weight of brick after immersed in water for 24 hours



Fig. 3.2 Water Absorption Test

3.3 Efflorescence Test on Brick

- The procedure to do efflorescence test is to fill the shallow dish with the distilled water and place the end of the brick up to 25mm depth.
- Place the whole arrangement in the warm ventilated room until the water in the dish are absorbed by the brick and surplus water evaporates.
- To avoid the excessive evaporation cover the dish with the cylinder.
- When the water has been absorbed and bricks appear to dry, place a similar quantity of water in the dish and allow it to evaporate as before. examine the brick for efflorescence after the second evaporation and report the results.
- The results on this test can be reported as nil, slight, moderate, heavy.
- Nil-there is no noticeable deposit of efflorescence.
- Slight-when thin deposit of salt is covered over exposed area of the brick surface but unaccompanied by faking.
- Serious-when there is heavy deposit of salt accompanied by powdering.



Fig. 3.3: Efflorescence Test on Brick

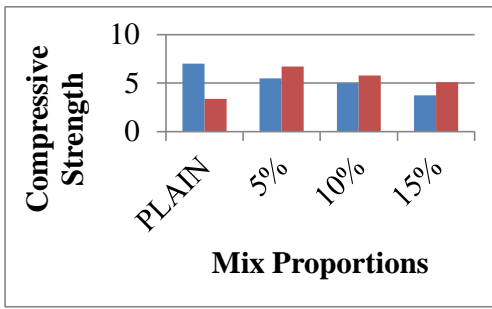
4. Results and Discussions

4.1 Compressive Strength Test Result

Table 4.1: Compressive Strength Results

S.NO	Percentage of Mix	Rectangular Burnt Clay Brick	Side Skew Burnt Clay Bricks
1	Plain Brick	7	3.386
2	5%	5.5	6.7
3	10%	5	5.8
4	15%	3.75	5.04

From the above table 4.1 the values are represented in Newton per mille meter square. The highest value are shown in 5% of side skew brick compared to the normal rectangular brick. The lowest value are obtained in the 15% of rectangular brick.



Graph 4.1: shows of Compressive Strength Test Results on Rectangular and Side Skew Burnt Clay Bricks

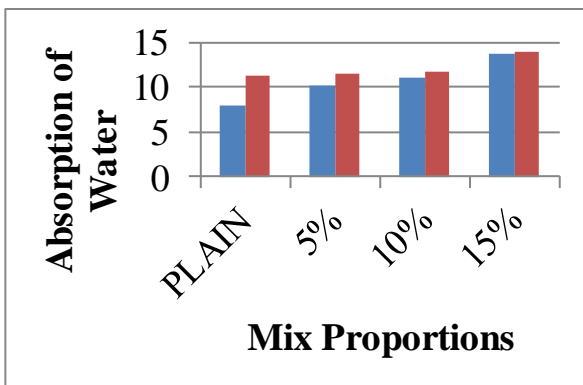
The above graph 4.1 represents the graphical comparison of compressive strength of side skew bricks. The highest value is noted in 5% of rice husk mix combination in side skew brick. The lowest value is noted in 15% of rice husk mix combination in side skew bricks.

4.2 Water Absorption Test Results

Table 4.2: Water Absorption Test Results

S.NO	Percentage of Mix	Rectangular Burnt Clay Brick	Skew Burnt Clay Bricks
1	Plain Brick	8%	11.2%
2	5%	10.18%	11.4%
3	10%	11.09%	11.6%
4	15%	13.6%	13.9%

From the above table 4.2 the highest value of water are absorbed in the 15% of the side skew brick. The lowest value of water are absorbed in the 5% of side of standard rectangular plain brick.



Graph 4.2: of Water Absorption Test Results On Rectangular And Side Skew Burnt Clay Bricks

The above graph 4.5 represent the graphical comparison of water absorbed in the side skew brick. The highest water are absorbed in the 15% of rice husk added in the side skew brick. Where the plain brick absorbs less water compared to the nominal mix.

4.3 Efflorescence Test Results

Slight-when thin deposit of salt is covered over exposed area of the brick surface but unaccompanied by faking. From the previous test results it is evident that the 5% mix has a better value.

Table 4.3: Results For Efflorescence

Samples	Precipitation Of Rice Husk
Plain Brick	No
5%	10%

10%	50% Without
15%	50% Without

From the above table 4.3 it is evident that the 10% and 15%mix shows a 50 % area covered with deposits of salts without any powder or flaking surface which is Moderate-efflorescence. The 5% mix shows 10 % area covered with deposit of salts which is Slight-efflorescence. The 0% mix shows No perceptible deposit which is Nil -efflorescence.

5. Conclusion

- The rice husk was partially replaced with the brick successfully in various mix proportions. The various mix proportions were 5%,10% and 15%.
- Finally the various mix proportion result were compared with each other and plain brick.
- From compressive test result it is evident that the rice husk replaced side skew brick possess high value at 5% compared to the other mixes
- From the water absorption test, the 15% of rice husk added both in side skew and rectangular brick absorb more water. The 5% of rice husk added in the side skew brick absorbs less water.
- From the density test, The 5% mix combination in side skew burnt clay brick shows a better density result when compared to all other mix and brick. While the density of brick decreases with increase in the rice husk.
- From efflorescence test it is evident that the 10% and 15%mix shows a 50 % area covered with deposits of salts without any powder or flaking surface which is Moderate-efflorescence. The 5% mix shows 10 % area covered with deposit of salts which is Slight-efflorescence. The 0% mix shows No perceptible deposit which is Nil -efflorescence.
- It is concluded that 5% of rice husk added shows that they can be used in the non load bearing wall at the external surface of the building.

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